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LARVAL CHARACTERS OF A NEOTROPICAL *SCOTOCRYPTUS* (COLEOPTERA: LEIODIDAE), A NEST ASSOCIATE OF STINGLESS BEES (HYMENOPTERA: APIDAE)

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Abstract.—Late instar larvae of a Neotropical species of *Scotocryptus,* tentatively identified as *S. meliponae* Girard and associated with adults determined as that species (Coleoptera: Leiodidae) are described from the nest of a stingless bee (Hymenoptera: Apidae: Meliponinae) in Manaus, Brazil. Habitus drawings and illustrations of selected characters are given to facilitate recognition of scotocryptine larvae and several characters are suggested to be adaptive apomorphs related to inquilinism, including dorso-ventral body compression, loss of stemmata, presence of stout spines, porelike cuticular structures, and an inverse c-shaped curvature of the body.

Scotocryptine beetles (Coleoptera: Staphylinoidea: Leiodidae) have been known inhabitants of nests of Neotropical stingless bees for more than a century (Girard, 1874), but details of this association remain enigmatic. Taxonomic, ecological, and behavioral studies are needed for all four genera of the Scotocryptini that are associated with Meliponinae (Hymenoptera: Apidae) (Portevin, 1907, 1937; Wheeler, 1979). Available evidence suggests that these beetles are scavengers in nests of host bees, feeding on feces and fungal spores and hyphae that are present (Salt, 1929; Wilson, 1971; Roubik and Wheeler, 1982); an interesting departure from epigean mycophagy in the related genera *Creagrophorus* and *Aglyptinus* (Newton, 1984; Wheeler, 1979, 1984). Adult structural peculiarities and phoretic behavior have been described by Roubik and Wheeler (1982).

There have been few published works on larvae of scotocryptines inhabiting bee nests, or their free-living relatives (Paulian, 1941; Peyerhimhoff, 1907; Wasmann, 1904; Wheeler, 1979). In this paper, I describe late instar larvae of *Scotocryptus meliponae* Girard and discuss some apomorphs apparently adaptive for inquilinism. These remarks, and accompanying figures, should facilitate recognition and collection of additional specimens, provide a basis for comparisons as more data are acquired, and suggest some structural details in need of further study.

MATERIALS AND METHODS

I have been able to study only a single series of four larvae of *S. meliponae.* These late (probably third) instar larvae were collected by D. W. Roubik and F. Perolta at Manaus, Brazil on May 7, 1981. Habitus drawings were made from a critical point dried specimen mounted on a point using a Wild M5A dissecting microscope with a drawing-tube. Detailed drawings were made from a slide mounted individual using a Leitz compound microscope equipped with interference contrast illumination and a drawing attachment. These two specimens, and a third in alcohol, are in the Cornell

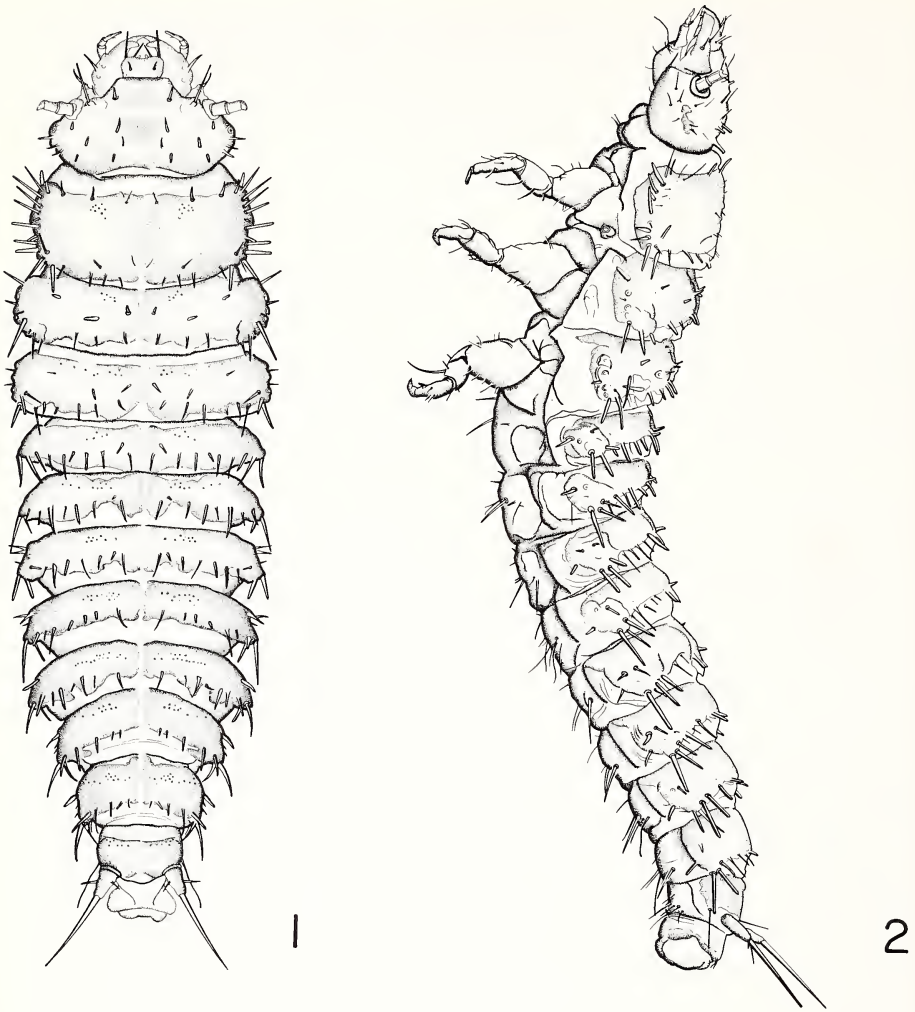
University Insect Collection. A fourth specimen (in alcohol) has been deposited in the Museum National d'Histoire Naturelle (Paris). I have used the term "pore" as a matter of convenience, as it has been used previously (e.g., Wheeler and Pakaluk, 1983), although some of these structures may be campaniform sensillae as suggested by Ashe and Watrous (1984). The special tergal "pores" discussed under adaptations, however, are not such sensillae.

DESCRIPTION OF LARVAL *Scotocryptus meliponae*

General features. Late instar larva. Body elongate, broad, somewhat dorso-ventrally flattened (Figs. 1, 2). Dorsum with many stout setae. Color creamy white (in ethanol). Length 7.4 mm distended.

Head. Head capsule broad (width/length = 1.5). Stemmata absent. Dorsal surface with small, simple setae; larger, blunt, fluted setae; and larger, lateral, fimbriate setae (approximate number and placement shown in Fig. 3); integument with crenulate microsculpture. Ventral surface with fewer, simple setae, except those at lateral margins. Antenna short; antennomere I (width/length = 0.8) with two dorsal pores; II more elongate (width/length = 0.53), ventral surface with imbricate scales, seta near apex, large oval sensillum in apical membrane, apicolateral seta, and small subapical sensillum and pointed cuticular process in membrane; III small (width/length = 1.0), with single dorsal sensillum, two ventral apicolateral sensillae (Fig. 5). Labrum with 2 large setae on disc, 2 large lateral setae; apical margin with 4 large, 2 small, and 2 minute setae; ventral surface with 2 subapical setae, apicolateral patches of microtrichiae, and 2 minute setae near middle subapically (Fig. 4). Mandible stout; apex with 2 large and 3 smaller dens; mola heavily sclerotized, not prominent, with poorly defined transverse ridges, each minutely crenulate; tooth at middle with point and crenulate edge; circular pit on ventral surface near medial tooth, with about a dozen long, fine setae (Figs. 6, 7). Maxilla elongate, narrow; mala undifferentiated, with fine setae along basal portion of inner margin, 4 large subapical dorsal setae, 3 large apical dens, fine setae subapically (ventral surface), and 1 long seta near base (ventrally); stipes with 3 ventral setae, 1 very long; palpus 3-segmented; palpomere I long, narrowed apically; II smaller, cylindrical; III elongate, narrowed apically, with large dorsal seta near base, single lateral seta, subapical pore, and several apical sensillae (Fig. 9). Labium with 2 setae ventrally on prementum; mentum with 3 pairs of setae, 1 pair of pores; submentum reduced to narrow sclerotized band with 2 setae; palpus 2-segmented; palpomere I (width/length = 0.26) with mesal pore and 3 dorsal, distal setae; II (width/length = 0.25) with single ventral pore, 2 lateral pores, and about 7 apical sensillae (Fig. 10).

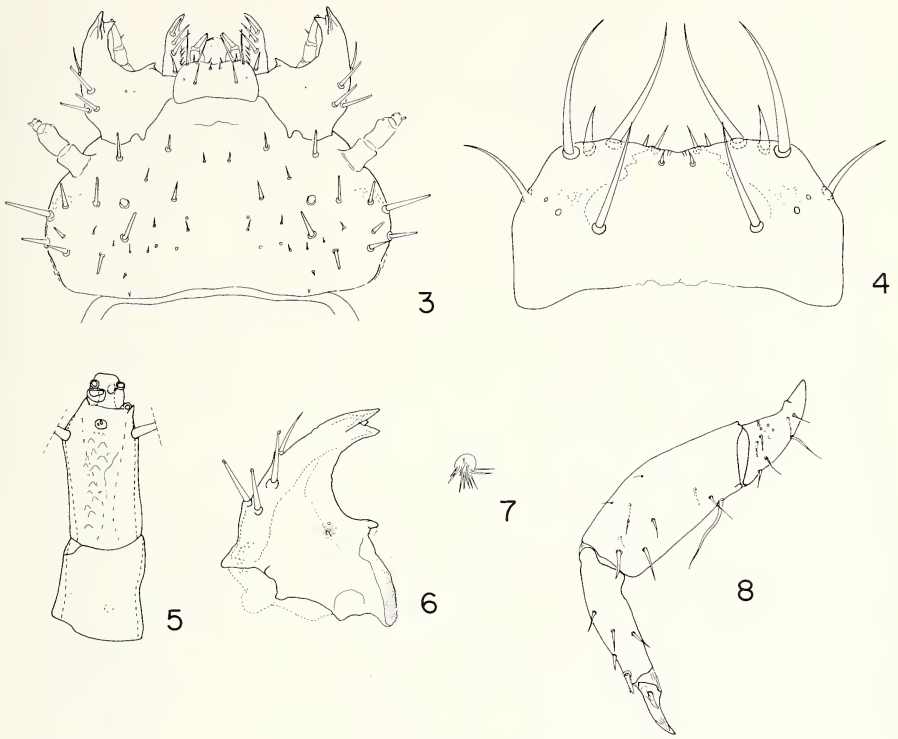
Thorax (Figs. 11, 12). Pronotum broad (length/width = 0.25), with large marginal setae (blunt, fimbriate-tipped); smaller, simple setae on disc; pore-like cuticular structures anteriorly; and 2 pairs of large, fimbriate setae on disc. Prosternum poorly defined, with 1 blunt seta and several smaller, simple setae; spiracle simple, circular, opening lined with minute setae. Metanotum similar to pronotum, with 3 pairs large, blunt setae on disc. Leg with large, elongate trochanter bearing ring of pores (including 2 dorsal and 5 ventral pores, 3 of which are arranged in transverse line) and several small, simple setae; femur stout, with long posterior seta near base, 3 dorsal setae, and about 8 ventral setae; tibia with 4 ventral setae (1 apico-lateral), 4 dorsal setae



Figs. 1, 2. *Scotocryptus meliponae,* habitus, putative third-instar. 1. Dorsal view. 2. Lateral view.

(1 apicolateral); tarsungulus stout, surface minutely grooved, bisetose (setae short, stout) (Fig. 8).

Abdomen. Tergum I with 5 pairs large, blunt, dorsal setae; with smaller blunt setae in transverse line between larger setae (present between setae 2/3, 3/4, and 4/5); 1 large lateral seta near anterior angle; 1 large lateral seta near posterior angle; 1 large posterior seta near posterior angle; with smaller, simple setae and pores anteriorly (Fig. 13). Sternite I with 3 very long, simple setae and several smaller, simple setae. Other tergites and sternites similar in setal pattern. Tergite IX with long posterolateral setae; only a few simple, minute setae on disc; sternite with 3 long setae and several



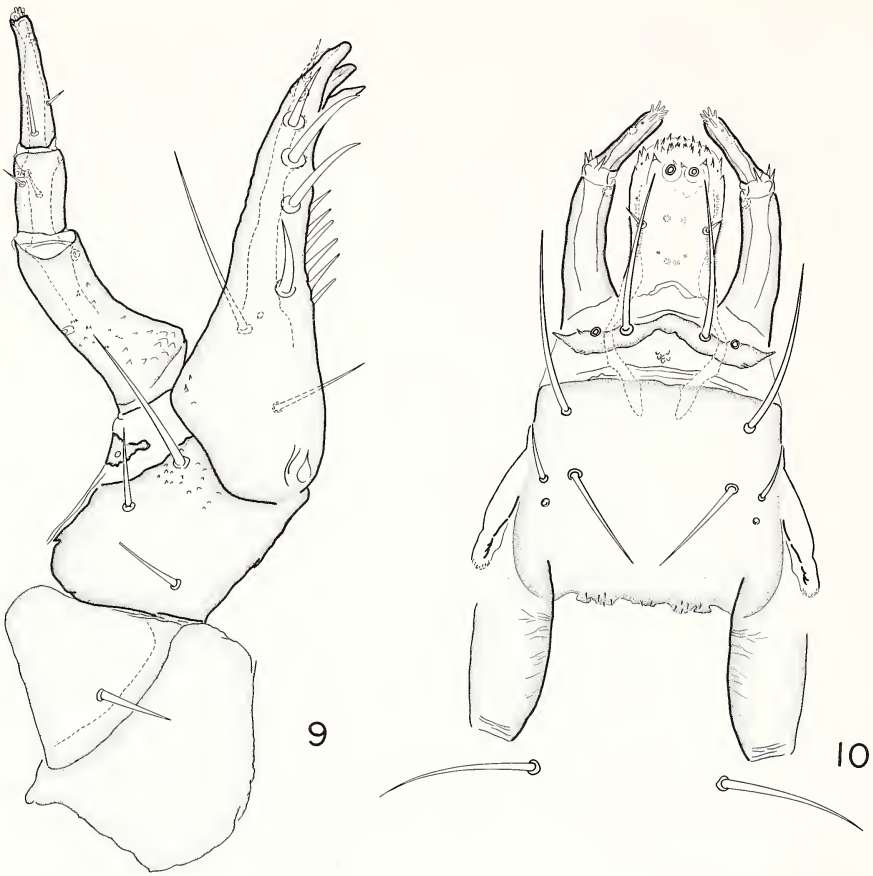
Figs. 3–8. *Scotocryptus meliponae.* 3. Cranium (dorsal). 4. Labrum (dorsal). 5. Antenna. 6. Left mandible (dorsal). 7. Mandibular sensillum (cf. Fig. 6). 8. Third leg (ventral).

smaller ones; urogomphus with stout base, bearing 1 large ventral seta, 2 large dorsal setae, several smaller setae, and terminating in very long, setose process.

ADAPTATIONS FOR INQUILINISM

Adult adaptations of *Scotocryptus* for inquilinism, including loss of flight and eyes, compact body form, grooves for appendages, and mandibular notches for grasping corbicular setae of hosts for phoretic flight, were presented by Salt (1929), Wilson (1971), and Roubik and Wheeler (1982). Larvae of these beetles, however, also exhibit apomorphs that appear to be adaptive for living in nests of meliponine bees. Stemmata are lost, paralleling blindness in adults. Dorsal setae are very heavy and while ostensibly tactile, they could be protective as well (Figs. 1, 2). Setae in related genera, such as *Creagrophorus* (Wheeler, 1979) and *Aglyptinus* (pers. obs.), are not so robust.

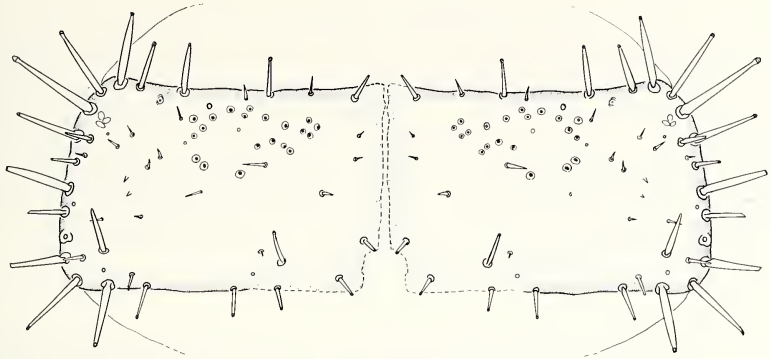
The pointed mala of the maxilla is distinctive from broader forms in related mycophagous leiodids, and is probably related to the ingestion of nest debris, largely consisting of bee feces (Roubik and Wheeler, 1982). Dorso-ventral compression of the body may also be a defensive adaptation, and there are porelike structures located



Figs. 9, 10. *Scotocryptus meliponae.* 9. Right maxilla (ventral). 10. Labium (ventral).

along the anterior margin of thoracic and abdominal terga of unknown function. Examination of these pores by compound microscopy reveals apparent cuticular openings, subtended by conical subcuticular areas. Even high magnifications (up to ×1,000), however, failed to find any evidence of cuticular reservoirs or ducts, associated with glands. Finally, the alcohol preserved specimens available to me were curved in an inverse c-shape. It is not known whether this posture is assumed by living beetles, but it is reminiscent of a defense posture reported by Arzone (1970, 1971) for a trufficolous species of *Leiodes.*

The adaptiveness of apomorphs is more easily speculated than demonstrated, and as Roubik and Wheeler (1982) suggested the larvae may be protected by neonatal acquisition of the nest odor, making the above speculations superfluous. Nonetheless, these structures are peculiar when compared to related, free-living beetles and the lives of scotocryptine larvae in the nests of their host bees deserve closer inspection.



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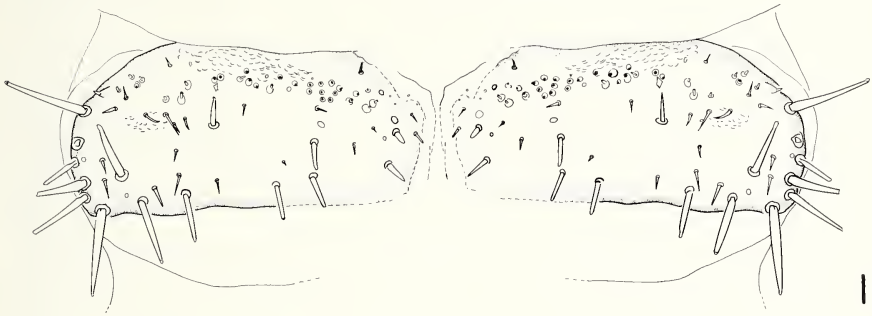

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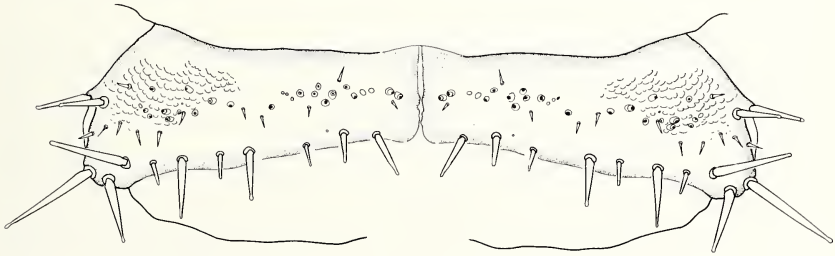

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Figs. 11–13. *Scotocryptus meliponae.* 11. Pronotum (dorsal). 12. Metanotum (dorsal). 13. Abdominal tergum I (dorsal).

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